

FILE TRANSFORMING OUTPUT ENGINE HAVING A DECOMPOSER AND  
MULTIPLE WRITERS

BACKGROUND OF THE INVENTION

5 The present invention relates to systems and devices that translate or convert computer files from one format to another. More particularly, the invention relates to systems and devices that convert form and document files from existing formats to xHTML and other tagged or embedded code formats that permit documents to function like database records.

10 In financial and other industries there are numerous systems used to generate forms and similar documents. For example, within the mortgage lending industry there are a number of loan origination systems, both open-standard and proprietary, that are used to produce different types of documents. For example, VMP Mortgage Forms software is used by a large number of lending institutions for home mortgage and similar transactions. Companies like VMP Mortgage Forms produce mortgage forms for the majority of state and other jurisdictions in the United States. Each jurisdiction may have different legal requirements related to the buying and selling of real estate and the associated loaning of funds to customers. Lending institutions find it more cost effective to use the forms generated by a form company, rather than use their own attorneys to ensure that the documents they use in mortgage transactions comply with the legal requirements of the many jurisdictions in which the lending institutions conduct business.

20 Most commonly, mortgage and other lending transactions are conducted using paper forms. These forms are printed using loan origination and other financial computer systems. The development of the Internet has led to increased interest in and execution of transactions using electronic forms. In theory, Internet and other available technologies allow financial transactions to be completed without the need to generate any paper documents. However, such ideal systems have not yet been developed.

25 One problem with current technology is that financial systems produce scores of different types of document file format outputs. Common file formats include .uff, .plc, .rtf, and .pdf. As is known, a file format is the internal structure of a file that defines the

way in which the file is stored within a computer system or memory. In addition, a file format may include various control instructions used by application programs and hardware devices.

#### SUMMARY OF THE INVENTION

5           The output formats used in current financial systems were selected prior to the birth and influence of the World Wide Web portion of the Internet. In general, these formats are incompatible with Internet requirements. Lender-specific data dictionaries (with attendant data mapping schemes) compound this problem. Internet incompatibility worsens when other file format requirements are considered. These problems are further  
10           multiplied by the recordation equipment requirements of more than 3,800 county recorders and 51 state jurisdictions.

          Accordingly, there is a need for a file format for financial and other forms that leverages the efficiencies and economies of the Internet. There is also a need for a system and device that converts files in existing formats to an Internet-leveraging file format.

15           The present invention provides, among other things, an output engine operable to convert a file from a first format to a second format. The output engine includes a decomposer that is called by a calling application. The decomposer receives an input file and a desired file format from the calling application. The decomposer decomposes the input file into a component architecture, making the properties of objects within the input  
20           file available to other components in the output engine. The output engine also includes a writer. The writer calls the decomposer multiple times to retrieve the component architecture of the file and generate a new version of the file in the second format.

          The output engine may include one or more additional writers. Preferably, each writer is configured to convert the input file to a different format. Each writer is designed  
25           to call the decomposer multiple times to retrieve the component architecture of the input file. The writers may be implemented in a chained fashion.

          In one embodiment, the decomposer includes a job processor. The job processor is operable to load pages of the file and associate data with each page. The decomposer may include a writer interface and a calling application interface. Each writer may include a

job processor interface, a layer processor, a collection processor, and an item processor. The layer, collection, and item processors interact with a stack, which stores components or portions determined by each processor. An output module retrieves the portions from the stack to generate an output file in the new format.

5           The invention also includes a method of converting an input file from a first format to a second format. The method includes delivering a desired file format and the input file to a decomposer; decomposing the input file into a component architecture in the decomposer; and generating a new version of the input file in the second format by calling the decomposer multiple times from a writer.

10           The method may also include sending the new version of the input file to a second writer, and generating a new version of the input file in a third format. The input file may be converted from a foreign file format to a common file format before it is converted to the second format.

15           In another embodiment, the invention provides a method of converting an input file having at plurality of pages and formatted in a first format to an output file formatted in a second format. The method includes receiving a file conversion request from a calling application; receiving the input file; loading each page, one page at a time, in a decomposer; associating data with one or more of the plurality of pages; decomposing objects in each page into a component architecture in a decomposer; driving each page to a  
20           writer; and generating the output file by calling the decomposer multiple times from the writer.

25           In yet another embodiment, the invention provides a file conversion system. The system includes a workstation having a source application, an output engine, and a document manager. The output engine is configured as noted above and includes a decomposer operable to be called by a calling application and to receive a file and a desired file format from the calling application. The decomposer decomposes the file into a component architecture. The system also includes a writer operable to call the decomposer multiple times to retrieve the component architecture of the file and generate a new version of the file in the second format. The workstation accesses a form data

database and a form database and is coupled to a server that has a document control and production engine.

As is apparent from the above, it is an advantage of the present invention to provide a system that converts files from one format to another. Other features and advantages of the present invention will become apparent by consideration of the detailed description and accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a schematic diagram of an exemplary system and suite of software tools used to create, view, edit, and print forms;

FIG. 2 is a schematic diagram illustrating a file in a first format, components of that file, and tools used to create that file.

FIG. 3 is a block diagram of an output engine having a decomposer and multiple writers;

FIG. 4 is a block diagram of a decomposer; and

FIG. 5 is a block diagram of a writer.

## DETAILED DESCRIPTION

Before embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of the construction and the arrangements of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced or being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. Furthermore, it is assumed that the reader is familiar with Windows programming and COM architecture.

FIG. 1 illustrates a system 10 that includes a server 12, a form data database 14, a network 18, a workstation 22, and a printer 26. The server 12 is coupled to the network 18 and includes an operating system 30 and a document control and production engine 32. The server may include other applications 34, such as standard communications software that, for purpose of brevity, are not discussed herein. The workstation 22 includes an operating system 36, a file retrieval and printing tool 38, an error-trapping utility 40, a viewing and editing tool 42, a form and document creation tool 44, an output engine 50, a document manager 52, and a source application 54. The workstation 22 may also include other applications 56 not directly pertinent to the invention. The server 12 communicates with the workstation 22 via the network 18. The source application 54 has access to or interacts with the form data database 14 to supply form data for the document manager 52. The form data database 14 may include a variety of information such as mortgagee name, address, loan amount, Social Security number, and other information. The exact type and extent of information stored in the form data database 14 depends upon the specific types of forms and documents to be created using the system 10 and is not limited to mortgage or other financial transaction data.

Some of the components of the system 10 may be implemented using currently available software. Table 1, below, sets out the names of components of the exemplary workstation 22 and commercially available products that are suitable for use as those components.

Table 1.

<u>Component</u>	<u>Commercially Available Product</u>
Operating system 36	MS Windows Operating Systems
File retrieval and printing tool 38	SeaReach component of I-32 ActiveX Server from CBF Systems, Inc.
Error-trapping utility 40	Jetsam component of I-32 ActiveX Server from CBF Systems, Inc.
Viewing and editing tool 42	Spyglass component of I-32 ActiveX Server from CBF Systems, Inc.

Form and document creation tool 44	LanYard component of I-32 ActiveX Server from CBF Systems, Inc.
Document manager 52	Client component of Rākis document control and production software from CBF Systems, Inc.

In the embodiment described, the source application 54 is, more precisely, a set of information stored in a Rākis runtime database. The runtime database is an open database connectivity ("ODBC") compliant database. The set of information provides the mapping between the database and common desktop environment ("CDE") base elements in the Rākis software.

Components of the server 12 may be implemented using commercially available software. Microsoft Windows operating system software may be used for the operating system 30. The server component of the Rākis document control and production software noted in Table 1 may be used for the document control and production engine 32. The database 14 may be implemented with any database that supports SQL queries and ODBC.

In general terms, the system 10 may be used to create new forms, or to modify or edit existing forms which may be available from a database such as a form database 60. Forms may include a number of blanks or data fields that may be populated with data from the form data database 14. The document manager 52 is used to access the document control and production engine 32. The document control and production engine 32 uses the source application 54 to create, modify, or edit forms, as is necessary. Resulting files may be printed on the printer 26.

For the example thus far illustrated and discussed, files created in the system 10 are formatted in a .ufx format. FIG. 2 schematically illustrates an exemplary.ufx file 70. Files in the .ufx format may include forms with empty data fields, such as form 72. Form 72 is formatted in a .uff format. .uff refers to "universal file format." .ufx refers to a .uff file merged with data from a .dtx file, hence .ufx. For the purposes of the discussion herein, populated forms are referred to as "documents." FIG. 2 illustrates an exemplary document 74.

FIG. 2 also illustrates that files in non-.ufx formats may be converted to a .ufx format using a converter 80. Birchski file conversion software available from CBF Systems, Inc. is suitable for use as the converter 80. Birchski software has the capabilities to transform .rtf, .afp, and other files types into .uff or .ufx files. In general terms, the  
5 converter 80 provides a mechanism for converting files in foreign or disparate file formats into a common file format which may then be converted into an Internet leveraging file format, as will be discussed further herein.

FIG. 2 also illustrates that the file retrieval and printing tool 38 can be used to  
10 export data files (which are .dtx files for the embodiment described). As noted above, form files merged or populated with data from .dtx files are referred to as documents.

FIG. 3 illustrates the output engine 50 in greater detail. In the embodiment shown, the output engine 50 is implemented in software and the software is written in Visual C++. Further, the software is constructed using Microsoft's component object model ("COM") architecture. As should be understood by those of ordinary skill in the art, COM defines a  
15 structure for building objects that can be called and executed in the Windows operating system. COM provides an interface between objects and distributed COM ("DCOM") allows objects to be executed remotely.

The output engine 50 includes a decomposer 90. The decomposer receives requests from a calling application, such as the document manager application 52. In  
20 general terms, the request sent to the output engine 50 is a solicitation to convert a file in a first format, such as .ufx, to a second format, such as xHTML. In other words, the output engine 50 converts a file from a standard or pre-existing format to an Internet-leveraging format.

In addition to receiving a conversion request from a calling application, the  
25 decomposer 90 also receives a file in a pre-existing format, such as input file 92. The request from the calling application includes a number of parameters that are used to set data attributes or properties of several writers 100 in the output engine 50. One such property is a writer ProgID. (As is known, a program ID or "ProgID" is a human-readable name that identifies a class. This name or string is placed in the system registry.) The  
30 writer ProgID identifies which of the several writers 100 will be used in the conversion of

the input file 92 from one format to another. In one embodiment, the output engine 50 includes three writers 100: a generalized xHTML writer, a specialized xHTML writer (such as a writer configured to produce files in the electronic format designated by FannieMae), and a second specialized writer. The second specialized writer may be a  
5 writer configured to produce files in a proprietary format such as the iLumin format. The iLumin format is designed for use in digital signing rooms.

The decomposer 90 loads each page of a form or document within the input file 92, one page at a time. The decomposer 90 also associates data with each page of the input file, if any, by calling export methods. The decomposer 90 also drives each page to an  
10 appropriate writer (as identified by the writer ProgID). As will be discussed further below, the decomposer 90 decomposes the properties of the file being converted to a new format and makes those decomposed properties available to the writers 100.

The writers 100 may be executed in a chained fashion. For example, the base xHTML writer may be executed to create an xHTML file. That file may then be sent to  
15 the Fannie Mae writer for conversion to the Fannie Mae format, which currently is a specialized xHTML format. After the writers have completed processing, a final output file, such as file 102 is generated. Even though each writer is designed to generate an output file in a specific format, the overall architecture of each writer is similar.

One advantage of the output engine 50 as compared to prior format conversion  
20 tools lies in the separation of the decomposer 90 from the writers 100. The output engine 50 is configured such that the subject writer does not need to know the details about the form or document in the input file 92. The pertinent writer only needs to know what objects are within the file and the end format desired (the syntax and semantics of the desired format). Further, the decomposer 90 does not need to know the details about the  
25 end format. The division of labor or functionality in the invention provides an architecture where writers can be readily added, modified, or deleted as needed depending on the number of end file formats required by the user.

FIG. 4 illustrates the decomposer 90 in greater detail. The decomposer 90 includes a first or calling application interface 105, a job processor 110, and a second or writer  
30 interface 115. The calling application interface 105 facilitates information exchange



between the output engine 50 and the calling application. Properties for an exemplary calling application interface 105 are set out in Table 2.

Table 2

DefaultDestinPath The Default Path For Destination Files	<i>String</i>
Version The Current Software Version	<i>Long (R)</i>
WriterID The progid of the Writer component	<i>String</i>

5                   Methods suitable for use with the properties set out in Table 2 include the following:

**ClearData**  
**Clear Data**

10                   Sub ClearData ( )

**ClearForm**  
**Clear Form**

15                   Sub ClearForm ( )

**clearWriterProperties**  
**Clear The Writer Property Bag**

20                   Sub clearWriterProperties ( )

**EndExport**  
**End export**

25                   Sub EndExport ( )

**Export**  
**Form or Doc to the Destination File**

30                   Sub Export ( )

**LoadData**  
**Load Date**

35                   Sub LoadData (ByVal LanDoc As Object,  
                    UserAuthString As Variant,  
                    AdminAuthString As Variant)

40                   **LoadForm**  
**Load Form**

                    Sub LoadForm (ByVal LanForm As Object)

**setWriterProperty**  
**Set The Writer Property Bag**

5 Sub setWriterProperty (ByVal name As String, ByVal value As String)

**StartExport**  
**Start export**

10 Sub StartExport (ByVal FileNameDestin As  
String)

15 The job processor 110 performs the main functions of the decomposer 90, which as noted above, include loading, a page at a time, each page of a form or document within the input file 92 and associating data, if any is applicable, with each page. The job processor 110 also drives each page to the subject writer 100. The subject writer 100 calls the writer interface 115 many times per page. The writer interface 115 provides file properties to the writer. The properties are generated by decomposing each object in an input file into its component parts. This decomposition may be performed in the job processor 110 using commercially available software distributed by CBF Systems, Inc. under the name  
20 Monsoon. The interface 115 provides an object model of each .uff and .cdd (“custom data descriptor”) file.

A type library for an exemplary writer interface 115 is set out below. Table 3 includes properties for the writer interface.

Table 3

Alignment (Alignment as Integer)	HRESULT (R)	LineCount (LineCount As Integer)	HRESULT (R)
AreaBottom (Bottom As Long)	HRESULT (R)	LineIndex (ByVal LineNumber As Integer, TextIndex As Integer)	HRESULT (R)
AreaEndOffset (EndOffset As Long)	HRESULT (R)	LineLength (ByVal LineNumber As Integer, Line Length As Integer)	HRESULT (R)
AreaLeft (Left As Long)	HRESULT (R)	LinePosX (ByVal LineNumber AS Integer, LinePosX As Long)	HRESULT (R)
AreaRight (Right As Long)	HRESULT (R)	LinePosY (ByVal LineNumber As Integer, Line)	HRESULT (R)
AreaStartOffset (StartOffset As Long)	HRESULT (R)	LineStatus (ByVal LineNumber As Integer, Line Status As slLineStatusEnum)	HRESULT (R)
AreaTop (Top As Long)	HRESULT (R)	LineWidth (ByVal LineNumber As Integer, Line Width as Long)	HRESULT (R)
BrushColor (Color As Long)	HRESULT (R)	PageHeight (Height As Long)	HRESULT (R)
BrushHatch (Hatch As monBrushhatchEnum)	HRESULT (R)	PageNumber (PageNumber As Long)	HRESULT (R)

BrushStyle (Style As monBrushstyleEnum)	HRESULT (R)	PageUnits (PageUnits As Long)	HRESULT (R)
Color (Color As Long)	HRESULT (R)	PageWidths (Width As Long)	HRESULT (R)
DataID (DataID As Integer)	HRESULT (R)	PenColor (Color As Long)	HRESULT (R)
Description (Description As String)	HRESULT (R)	PenStyle (Style As monPenstyleEnum)	HRESULT (R)
DesignHeight (DesignHeight As Integer)	HRESULT (R)	PenWidth (Width As Long)	HRESULT (R)
DesignWidth (DesignWidth As Integer)	HRESULT (R)	Position (Position As Integer)	HRESULT (R)
DocName (DocName As String)	HRESULT (R)	RawData (ByVal DataID As Integer, Text As String)	HRESULT (R)
EndX (EndX As Long)	HRESULT (R)	RoundingX (RoundX As Long)	HRESULT (R)
EndY (EndY As Long)	HRESULT (R)	Rounding Y (RoundY As Long)	HRESULT (R)
FirstLineTop (LineTop As Long)	HRESULT (R)	ShadowColor (Color As Long)	HRESULT (R)
FontAscent (Ascent As Long)	HRESULT (R)	StartX (StartX As Long)	HRESULT (R)
FontCPointSize (CPointSize As Integer)	HRESULT (R)	StartY (StartY As Long)	HRESULT (R)
FontFaceName (FaceName As String)	HRESULT (R)	TabSpace (TabSpace As Long)	HRESULT (R)
FontID (FontID As Integer)	HRESULT (R)	Text (TextString As String)	HRESULT (R)
FontRange (ByVal Start As Integer, End As Integer)	HRESULT (R)	WriterUnits (Units As Long)	HRESULT (R)
FontSet (FontSetName As String)	HRESULT (R)		
ItemsCount (Count As Long)	HRESULT (R)		
LayersCount (Count As Long)	HRESULT (R)		
Leading (Leading As Long)	HRESULT (R)		
FontStyle (Style As Integer)	HRESULT (R)		
FontWeight (Weight As Integer)	HRESULT (R)		
FontWidths (ByVal Character As Integer, Width As Long)	HRESULT (R)		
FormName (FormName As String)	HRESULT (R)		

Exemplary Methods suitable for use with the writer interface 115 defined using the properties in Table 3 are listed below.

#### ExportToPCL

5       Function ExportToPCL (ByVal FileName As String)  
          As HRESULT

#### ExportValue

10       Function ExportValue (ByVal FileName As String)  
          As HRESULT

#### GetMetaData

15       Function GetMetaData (ByVal MetaName As String,  
          pDoc As Object) As HRESULT

getWriterProperty

Function getWriterProperty (ByVal name As  
String, value As String) As HRESULT

5

PopCurrentObjectID

Function PopCurrentObjectID ( ) As HRESULT

10

PushCurrentObjectID

Function PushCurrentObjectID ( ) As  
HRESULT

15

setCurrentCollection

Function setCurrentCollection (ByVal  
ObjectType As slObjectTypeEnum) As HRESULT

20

setCurrentItem

Function setCurrentItem (ByVal Index As  
Long) As HRESULT

25

setCurrentLayer

Function setCurrentLayer (ByVal Layer As  
Long) As HRESULT

30

FIG. 5 illustrates an exemplary writer 100 in additional detail. The writer illustrated includes a job processor interface 140, a layer processor 145, a collection processor 150, an item processor 155, a stack 160, and output module 165.

The interface 140 facilitates communication between the writer 100 and the job processor 110. A type library for an exemplary job processor interface 140 is set out below. Properties for the job processor interface 140 are listed in Table 4.

35

Table 4

SkylonInterface The Skylon Interface		<i>IskylonForWriter (W)</i>
Version (Version As Long) Writer Version	The Current	<i>HRESULT (R)</i>

Methods suitable for use with the job processor interface 140 include the following:

40

BeginWrite

Begin to Write Output File

Function BeginWrite (ByVal FileName  
As String) As HRESULT

EndWrite  
End to Write Output File

Function EndWrite ( ) As HRESULT

WritePage  
Write Output File

Function WritePage ( ) As HRESULT

The interface 140 provides information to the three processors 145, 150, and 155. Processors 145, 150, and 155 are configured in a nested loop. As noted, the files processed by the exemplary embodiment discussed thus far represent forms. These forms may be structured in layers: a base layer and one or more overlays. In the example discussed, .cdd files are used to add layers of information to a form. Each layer has a number of collections and each collection has a number of different items. As each portion of a page is processed, layers, collections, and items are identified and determined. As each layer, collection, and item is determined, the determined materials or portions are pushed onto the stack 160. The output module 165 assembles each determined portion in the order needed, as determined by the output format set up by the calling application. The compiled components make up the output file generated by the output engine 40. The output file is in a different format than the input file, preferably an Internet leveraging file format.

As can be seen from the above, the present invention provides an output engine with a decomposer and one or more writers that converts a file in a first format to a file in a second format.

Various features and advantages of the invention are set forth in the following claims.